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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/813,439  | 03/31/2004  | Sung-Sok Choi        | SEC.1140            | 3777             |
| 20987   | 7590        | 08/14/2006           | EXAMINER            |                  |
| VOLENTINE FRANCOS, & WHITT PLLC<br>ONE FREEDOM SQUARE<br>11951 FREEDOM DRIVE SUITE 1260<br>RESTON, VA 20190 |             |                      | ZERVIGON, RUDY      |                  |
|   |             |                      | ART UNIT            | PAPER NUMBER     |
|   |             |                      | 1763                |                  |

DATE MAILED: 08/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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|                              |                                      |                                    |  |
|------------------------------|--------------------------------------|------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/813,439 | <b>Applicant(s)</b><br>CHOI ET AL. |  |
|                              | <b>Examiner</b><br>Rudy Zervigon     | <b>Art Unit</b><br>1763            |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 May 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2,4-6 and 9-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-6 and 9-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 2, 4-6, and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim; Byong-dong et al. (US 5,990,016 A) in view of Strang; Eric J. (US 6,872,259 B2). Kim teaches an upper electrode (71/81; Figure 7, column 4, line 49 – column 5, line 22) for supplying process gas onto a wafer (13; Figure 7) in semiconductor device manufacturing equipment (Figure 7, column 4, line 49 - column 5, line 22), comprising: a plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22), and a plurality of nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22) integral with said plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22) so as to inject process gas supplied at one side of the plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22) into a processing chamber (column 5, lines 9-10) from the other side of the plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22), said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22) being configured to inject the process gas at a flow rate that is higher overall at a peripheral portion of said plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22) than at a central portion of said plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22) located radially inwardly of the peripheral portion (column 5, lines 10-33) – claim 1

Kim further teaches:

- i. The electrode as claimed in 1, wherein said plurality of nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22) are identical with respect to their configurations such that said

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nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) will inject the process gas at equal flow rates, as claimed by claim 2.

ii. The electrode as claimed in 3, wherein the nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) within each said group (Figure 8) have the same configurations so as to inject the process gas at the same flow rate (column 5, lines 10-33), as claimed by claim 4

The electrode as claimed in 3, wherein said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) at the peripheral portion of the plate electrode (71/81; Figure 7, column 4, line 49 - column 5,line22) have through-holes (82, 82a; Figure 8, column 4, line 49 - column 5,line22) that are larger (column 5, lines 10-33) than those of the nozzle at the central portion of the plate electrode (71/81; Figure 7, column 4, line 49 - column 5,line22), as claimed by claim 5

Kim does not teach:

i. one nozzle of the plurality of nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) being disposed at the center of the electrode plate (71/81; Figure 7, column 4, line 49 - column 5,line22), the remainder of the nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) being disposed in a plurality of concentric groups about the concentric nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22), the nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) in each group being spaced apart from one another by equal amounts, the intervals between the central nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) in any one group and closest nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) in an adjacent group being decreased in a direction from the center of the electrode plate (71/81; Figure 7, column 4, line 49 - column 5,line22) toward the outer peripheral edge portion thereof - claim 1

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ii. Semiconductor manufacturing equipment, comprising: a processing chamber (column 5, lines 9-10); a supply line (not shown; inherent; Figure 8) through which process gas is supplied to Kim's chamber (column 5, lines 9-10); a plurality nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) being configured to inject the process gas at a flow rate that is higher overall at a peripheral portion of said plate electrode than at a central portion of said plate electrode located radially inwardly of the peripheral portion, one nozzle of the plurality of nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) being disposed at the center of the electrode plate (71/81; Figure 7, column 4, line 49 - column 5,line22) the remainder of the nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) being disposed in a plurality of concentric groups about the central nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22). the nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) in each group being spaced apart from one another by equal amounts the intervals between the central nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) in any one group and closest nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) in an adjacent group being decreased in a direction from the center of the electrode plate (71/81; Figure 7, column 4, line 49 - column 5,line22) toward the outer peripheral edge portion thereof; a controllable distributor operatively interposed between said supply line (not shown; inherent; Figure 8) and said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22) so as to control the flow of the process gas from the supply line (not shown; inherent; Figure 8) to the nozzles (82, 82a; Figure 8, column 4, line 49 - column 5,line22); an exhaust system connected to said processing chamber (column 5, lines 9-10) to create a vacuum within the chamber (column 5, lines 9-10); a pressure sensor that measures the pressure in the chamber (column 5, lines 9-10) interior; a database that stores

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information regarding the processing of a wafer (13; Figure 7) within Kim's chamber (column 5, lines 9-10); and a controller operatively connected to said database so as to receive the information stored by the database, operatively connected to said pressure sensor and said exhaust system so as to control the exhaust system to regulate the pressure with the chamber (column 5, lines 9-10) on the basis of the pressure sensed by said sensor, and operatively connected to said distributor for controlling the distributor to regulate the flow of the process gas to said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22), as claimed by claim

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iii. The equipment as claimed in 9, wherein the distributor comprises: pipes diverging from the supply line (not shown; inherent; Figure 8) and each connected to a respective one of the nozzles (82a; Figure 8, column 4, line 49 - column 5, line 22); and a control valve disposed in-line with the divergent pipes, and operatively connected to said controller, as claimed by claim

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iv. The equipment as claimed in 10, wherein the distributor comprises: a support plate disposed above said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22); and control members supported by said support plate so as to be movable in a direction towards and away from said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22); and an elevating mechanism operatively connected to said control members so as to position said control members relative to said control valve, said elevating mechanism being operatively connected to said controller, as claimed by claim 11

v. The equipment as claimed in 11, and further comprising a plate electrode (71/81; Figure 7, column 4, line 49 - column 5, line 22) with which said nozzles (82, 82a; Figure 8, column 4, line

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49 - column 5, line 22) are integrated, said having a plurality of grooves extending from an upper surface thereof to each of said nozzles (82, 82a; Figure 8, column 4, line 49 - column 5, line 22), respectively, and wherein each of said control members has a lower end having a shape corresponding to the shape of a respective one of said grooves and is disposed opposite thereto, whereby the control members can be seated in said grooves, as claimed by claim 12

Strang teaches one nozzle of the plurality of nozzles (160; Figure 3G-I; 250; Figure 5) being disposed at the center of the electrode plate (50; Figure 5; column 9, lines 23-43), the remainder of the nozzles (160; Figure 3G-I; 250; Figure 5) being disposed in a plurality of concentric groups (450; Figure 5) about the concentric nozzles (160; Figure 3G-I; 250; Figure 5), the nozzles (160; Figure 3G-I; 250; Figure 5) in each group (450; Figure 5) being spaced apart from one another by equal amounts - claim 1,9

Strang further teaches a controllable distributor (Figure 3G) operatively interposed between said supply line (74', 74'', 74'''; Figure 3G) and said nozzles (160; Figure 3G-I) so as to control the flow of the process gas from the supply line (74', 74'', 74'''; Figure 3G) to the nozzles (160; Figure 3G-I); an exhaust system (66; Figure 2B) connected to said processing chamber (14; Figure 2B) to create a vacuum within the chamber (14; Figure 2B); a pressure sensor (column 17, lines 27-40) that measures the pressure in the chamber (14; Figure 2B) interior; a database (80; Figure 2B) that stores information regarding the processing of a wafer (13; Figure 7) within Strang's chamber (14; Figure 2B); and a controller (80; Figure 2B) operatively connected to said database (80; Figure 2B) so as to receive the information stored by the database (80; Figure 2B), operatively connected to said pressure sensor (column 17, lines 27-40) and said exhaust system

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(66; Figure 2B) so as to control the exhaust system (66; Figure 2B) to regulate the pressure with the chamber (14; Figure 2B) on the basis of the pressure sensed by said sensor, and operatively connected to said distributor (Figure 3G) for controlling the distributor (Figure 3G) to regulate the flow of the process gas to said nozzles (160; Figure 3G-I) - claim 9

vi. The equipment as claimed in 9, wherein the distributor (Figure 3G) comprises: pipes (150', 150'', 150'''; Figure 3G) diverging from the supply line (74', 74'', 74'''; Figure 3G) and each connected to a respective one of the nozzles (160; Figure 3G); and a control valve (154; Figure 3C,G) disposed in-line with the divergent pipes (150', 150'', 150'''; Figure 3G), and operatively connected to said controller (80; Figure 2B), as claimed by claim 10

vii. The equipment as claimed in 10, wherein the distributor (Figure 3G) comprises: a support plate (154; Figure 3C,G) disposed above said nozzles (160; Figure 3G-I); and control members (160L; Figure 3B) supported by said support plate (154; Figure 3C,G) so as to be movable in a direction towards and away from said nozzles (160; Figure 3G-I); and an elevating mechanism (180; Figure 3B) operatively connected to said control members (160L; Figure 3B) so as to position said control members (160L; Figure 3B) relative to said control valve (154; Figure 3C,G), said elevating mechanism (180; Figure 3B) being operatively connected to said controller (80; Figure 2B), as claimed by claim 11

viii. The equipment as claimed in 11, and further comprising a plate electrode (90; Figure 2B) with which said nozzles (160; Figure 3G-I) are integrated, said having a plurality of grooves (166i; Figure 3I) extending from an upper surface thereof to each of said nozzles (160; Figure 3G-I), respectively, and wherein each of said control members (160L; Figure 3B) has a lower end having a shape corresponding to the shape of a respective one of said grooves (166i; Figure



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3I) and is disposed opposite thereto, whereby the control members (160L; Figure 3B) can be seated in said grooves (166i; Figure 3I), as claimed by claim 12

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add Strang's controllable distributor (Figure 3G), with optimized nozzle distribution of Strang's Figure 5, to Kim's apparatus.

Motivation to add Strang's controllable distributor (Figure 3G), with optimized nozzle distribution of Strang's Figure 5, to Kim's apparatus is for improving etching and deposition processes as taught by Strang (column 8; lines 30-40) and for optimizing "the coalescence of gas jets, or to increase or decrease the flux of fresh gas in chosen areas over the wafer" as taught by Strang (column 16, lines 4-23).

### ***Response to Arguments***

3. Applicant's arguments with respect to claims 1, 2, 4-6, and 9-12 have been considered but are moot in view of the new grounds of rejection.

### ***Conclusion***

4. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272-1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (571) 273-8300. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Parviz Hassanzadeh, at (571) 272-1435.

*Rudy Zervigon*  
8/9/6